Chandra finds Milky Way's black hole grazing on asteroids

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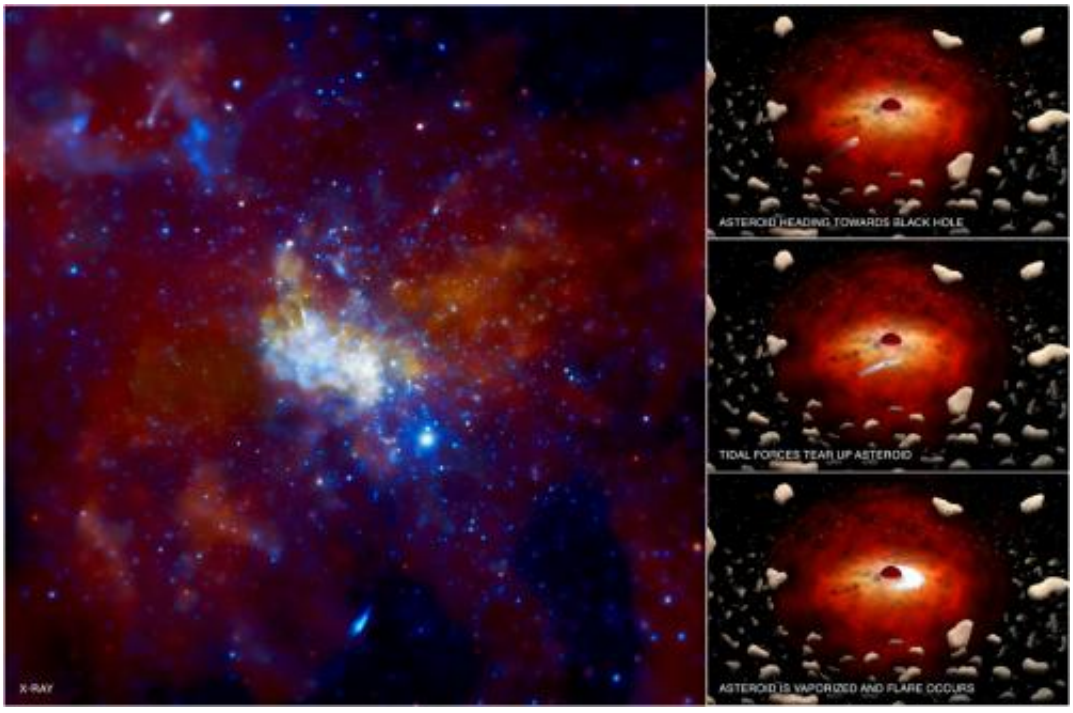

A new study provides a possible explanation of mysterious X-ray flares detected by Chandra over the period of several years. It suggests that there is a cloud around Sgr A* containing trillions of asteroids and comets, stripped from their parent stars. The flares occur when asteroids of six miles or larger in radius are consumed by the black hole. The panel on the left shows a very long Chandra observation of the region around the Sgr A*, while the three panels on the right are artist's impressions of the path that a doomed asteroid would take on its way to the black hole. Credit: X-ray: NASA/CXC/MIT/F. Baganoff et al.; Illustrations: NASA/CXC/M.Weiss

(PhysOrg.com) -- The giant black hole at the center of the Milky Way may be vaporizing and devouring asteroids, which could explain the frequent flares observed, according to astronomers using data from NASA's Chandra X-ray Observatory.

For several years Chandra has detected X-ray flares about once a day from the supermassive black hole known as Sagittarius A*, or "Sgr A*" for short. The flares last a few hours with brightness ranging from a few times to nearly one hundred times that of the black hole's regular output. The flares also have been seen in infrared data from ESO's Very Large Telescope in Chile.

"People have had doubts about whether asteroids could form at all in the harsh environment near a supermassive black hole," said Kastytis Zubovas of the University of Leicester in the United Kingdom, and lead author of the report appearing in the Monthly Notices of the Royal Astronomical Society. "It's exciting because our study suggests that a huge number of them are needed to produce these flares."

Zubovas and his colleagues suggest there is a cloud around Sgr A* containing trillions of asteroids and comets, stripped from their parent stars. Asteroids passing within about 100 million miles of the black hole, roughly the distance between the Earth and the sun, would be torn into pieces by the tidal forces from the black hole.

These fragments then would be vaporized by friction as they pass through the hot, thin gas flowing onto Sgr A*, similar to a meteor heating up and glowing as it falls through Earth's atmosphere. A flare is produced and the remains of the asteroid are swallowed eventually by the black hole.

"An asteroid's orbit can change if it ventures too close to a star or planet near Sgr A*," said co-author Sergei Nayakshin, also of the University of

Leicester. "If it's thrown toward the black hole, it's doomed."

The authors estimate that it would take asteroids larger than about six miles in radius to generate the flares observed by Chandra. Meanwhile, Sgr A* also may be consuming smaller asteroids, but these would be difficult to spot because the flares they generate would be fainter.

These results reasonably agree with models estimating of how many asteroids are likely to be in this region, assuming that the number around stars near Earth is similar to the number surrounding stars near the center of the Milky Way.

"As a reality check, we worked out that a few trillion asteroids should have been removed by the black hole over the 10-billion-year lifetime of the galaxy," said co-author Sera Markoff of the University of Amsterdam in the Netherlands. "Only a small fraction of the total would have been consumed, so the supply of asteroids would hardly be depleted."

Planets thrown into orbits too close to Sgr A* also should be disrupted by tidal forces, although this would happen much less frequently than the disruption of asteroids, because planets are not as common. Such a scenario may have been responsible for a previous X-ray brightening of Sgr A* by about a factor of a million about a century ago. While this event happened many decades before X-ray telescopes existed, Chandra and other X-ray missions have seen evidence of an X-ray "light echo" reflecting off nearby clouds, providing a measure of the brightness and timing of the flare.

"This would be a sudden end to the planet's life, a much more dramatic fate than the planets in our solar system ever will experience," Zubovas said.

Very long observations of Sgr A* will be made with Chandra later in 2012 that will give valuable new information about the frequency and brightness of flares and should help to test the model proposed here to explain them. This work could improve understanding about the formation of asteroids and planets in the harsh environment of Sgr A*.

Provided by Chandra X-ray Center